EDC 356 – Methods and Materials: Teaching Science in the Elementary School
Fall 2013: Course Syllabus

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Catalog Course Description
This course is designed to provide an integrated approach to the science K-8 curriculum in elementary and middle schools. Emphasis is on the development of daily, weekly, and unit lesson plans. A variety of instructional strategies, including hands-on activities, will be reviewed and practiced. Students will be expected to participate in a teaching team and create integrated thematic lessons. Prerequisite: admission to the teacher education program or permission of instructor.

Applicable Montana PEPP Standards: 508.58.508

- (a) Demonstrate knowledge and understanding and use the major concepts, principles, theories, and research related to the development of children and young adolescents to construct learning opportunities that support individual students' development, acquisition of knowledge, and motivation.

- (b) Demonstrate knowledge and understanding and use the central concepts as outlined in Montana's student content and performance standards, tools of inquiry, and structures of content for students across grades K-8 and can engage students in meaningful learning experiences that develop students' competence in subject matter and skills for various developmental levels.

- (b) (ii) Demonstrate knowledge and understanding of and use the fundamental concepts in the subject matter of science, including physical, life, earth, and space sciences, as well as concepts in science and technology, science in personal and social perspectives, the history and nature of science, including American Indian scientific contributions, the unifying concepts of science, and the inquiry processes scientists use in discovery of new knowledge to build a base for scientific literacy.

- (b) (vii) Demonstrate knowledge and understanding of and use interdisciplinary connections to integrate subject matter contents, employing inclusive ideas and issues that engage students' ideas, interests, concerns, and experiences

- (c) Plan and implement instruction based on knowledge of individual students, learning theory, subject matter, curricular goals, and community.

- (c) (i) Demonstrate understanding of how students within different populations, including Montana American Indians, differ in their development and approaches to learning and create instructional opportunities that are adapted to diverse learners.

- (c) (ii) Demonstrate understanding of and use a variety of teaching routines and strategies that encourage students' development of critical thinking, problem solving, and performance skills, including the appropriate use of current and emerging technologies.

- (c) (iii) Apply knowledge and understanding of individual and group motivation and behavior among students to develop active engagement in learning, self-motivation, and positive interaction and to create supportive learning environments.

- (c) (iv) Apply knowledge and understanding of effective verbal, nonverbal, and electronic communication techniques to develop inquiry, collaboration, and supportive interaction

- (d) Demonstrate knowledge and understanding of and use formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social-emotional, and physical development of each student.

Standards Based Course Goals and Learner Outcomes
This course is designed to facilitate your growth as an effective teacher of elementary Science. At the conclusion of this course you should:

- Have a clear understanding of your own philosophy about teaching Science
- Be able to write meaningful and clear lesson objectives
- Be able to write effective, creative, original Science lesson plans
- Be able to demonstrate effective teaching techniques
- Have a broader understanding of Science content
- Create effective methods of introducing and teaching new Science content
- Develop a philosophy regarding effective classroom management techniques
- Be able to create plans and teach in a way that meets the needs of all learners
- Have a clear understanding of Montana Standards and Next Generation Science Standards
- Recognize and exploit the rich opportunities to make a positive difference in the lives of your students through effective, dynamic Science instruction

Assessment
Learner outcomes will be assessed using scoring rubrics designed to measure the degree to which assigned projects reflect and demonstrate the student's understanding and proficiency in each of the specified outcomes.

Text
Science Stories: Science Methods for Elementary and Middle School Teachers, 5th Edition
Janice Koch Hofstra University
ISBN-13: 9781111833435

Required Materials
Text, notebook, 3-ring binder, and journal; Additional materials may be required for specific projects.

Attendance
Attendance is essential because class experiences cannot be recreated independently. Missing more than three classes will result in your final grade being reduced by 1/3 of a letter grade (i.e. B reduced to B-). If difficulties or special circumstances arise please contact me.

Academic Responsibilities and Accountability
This syllabus represents a learning contract. Your success in the course is dependent upon successful completion of course requirements, assignments, and tasks while maintaining high standards of academic integrity as described in the college catalog on pages 41 - 42. Please review and familiarize yourself with this material.

Grading
All of your work throughout the semester should be kept in a three ring binder portfolio, and saved electronically. Your final grade will be determined through a final evaluation of your work and the progress you have demonstrated. The percentages listed below are provided as a guideline to help you to understand the scope and importance of the various elements of the course content.

1. Personal Science autobiography and philosophy 10 %
2. Science Experiments 40 %
3. Full lesson (planning and delivery) 15 %
4. Thematic Unit 35 %

Grade Range:	A	95 - 100	B	83 - 86	C	73 - 76	D	63 - 66
	A-	90 - 94	B-	80 - 82	C-	70 - 72	D-	60 - 62
	B+	87 - 89	C+	77 - 79	D+	67 - 69	F	Below 60

Course Outline and Assignments
The specific descriptions of assignments and tasks are listed below. Please be aware that any of these tasks may be modified. You will always be notified of any changes in scope, requirements, sequence, or schedule.

Personal Science Autobiography and Philosophy (Suggested length: 2 - 3 pages)
Part One - Your Experiences as a Science Learner
Write about your learning experiences in Science throughout your educational career as a student. What topics, lessons, teachers, incidents, or experiences had positive or negative impacts on how well you learned Science, and how you perceive Science. What was their impact and why? See pages 46 – 49 in the text to help you.

Part Two – Developing your Philosophy of Teaching Science
Review the Next Generation Science Standards to review the topics you will be teaching:
http://www.nextgenscience.org/search-standards

Now read the following excerpt from the Montana Standards:

"Science is an inquiry process used to investigate natural phenomena, resulting in the formation of theories verified by directed observations. Inquiry challenges students to solve problems by observing and collecting data and constructing inferences from those data. In doing so, students acquire knowledge and develop a rich understanding of concepts, principles, models, and theories. Inquiry requires the use of scientific thinking skills to address open-ended problems through non-prescriptive procedures and allows students to construct their own knowledge of the specific concepts. This validates different ways of gathering, synthesizing and communicating knowledge. Scientific theories are challengeable and changeable. Data used to support or contradict them must be reproducible.

A goal of science education "is to help students recognize the difference between personal opinion and knowledge gained through scientific investigation and debate."

Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results.

Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. Students will engage in selected aspects of inquiry as they learn the scientific way of knowing the natural world, but they also should develop the capacity to conduct complete inquiries.

Although science as a body of knowledge is ever changing, the processes of science are constant. In scientific inquiry, a problem is identified, pertinent data is gathered, hypotheses are formulated, experiments are performed, the results are interpreted, and conclusions are drawn. Science education strengthens students' investigative skills and fosters their understanding of the world. Students acquire and apply critical thinking and problem-solving skills necessary to participate as citizens in dynamic, global technological societies. Thinking skills, for example, observing, measuring, classifying, predicting, deducing, and inferring are given meaning by the context of the subject matter being studied."

After reflecting on the Montana Standards excerpt and the topics you will need to teach, develop a philosophy statement on how you will teach science in the future:

Science Demonstrations / Mini- Lessons

We will strive to create an interactive, dynamic learning environment in which your participation and input is vital. Everyone will teach and learn from each other in an environment that encourages creativity, the free flow of ideas, and a great deal of learning and interaction. Throughout the semester you will be asked to demonstrate science experiments from the text or other sources

Lesson Plan and Teaching

Teach a full (30 minute) standards based science lesson from your thematic unit or on another topic such as Yellowstone National Park. You will need to provide all materials needed to teach the lesson and tell the class in advance if you want them to bring any materials.

Your lesson will be evaluated on the following:

- Creativity and inquiry-based learning
- Clear objectives and success in meeting those objectives
- Clear, motivating introduction
- Logical scope and sequence of activities

Creativity Appropriate adaptations

- Clear effective presentation
- Clear closing strategy
- Appropriate assessment
- Standards based content

Five Lesson Thematic Science Unit

Thematic units investigate one theme from a variety of perspectives and approaches. Using a thematic concept of instruction connects topics within the subject area, expands and enhances understanding, increases motivation, and provides a holistic learning experience. Create, develop and write a one-week Science Thematic Unit consisting of 5 complete lessons. The unit can be designed for any grade from K - 8. The first step is to pick a theme. You can use one of the examples listed below or a Science topic of your own choosing. Possible themes include:

- Matter
- Simple Machines
- Electricity
- Weather/Climate
- Space
- Geology
- Oceans
- Energy
- Environment
- Plants
- Animals
- Health Science

Required Elements:

1. General description of the unit including a brief description of how this unit could be incorporated with other subjects as an interdisciplinary unit. Cite THREE specific examples of connections that could be made with other subjects.

2. One paragraph Unit Objective that is a well-written description of the theme and the overriding instructional objectives of the unit. The unit objective gives direction and meaning to the unit.

   Example: Thematic Unit on Simple Machines
   TSWBAT develop a deeper understanding of the function and importance of simple machines in the real world by completing a series of related projects, problem solving, and hands on lesson activities over the course of five lessons. The unit will enable students to understand, use and demonstrate simple machines, and then to apply this knowledge to solve a variety of problems and questions.

3. Five well-written ORIGINAL standards-based Science full lesson plans following the template.

Course Schedule and Project Due Dates

Week One
Reading: Chapter 1
8.27 Class 1 – Course Introduction
8.29 Class 2 – Chapter 1: An Invitation to Teaching Science

Week Two
Reading: Chapters 2 and 3
9.3 Class 3 - Chapter 2: Locating Your Scientific Self
9.5 Class 4 - Chapter 3: Teachers and Students as Science Learners

Week Three
Science Autobiography due on Tuesday
Reading: Chapters 3 and 4
9.10 Class 5 - Chapter 3: Teachers and Students as Science Learners
9.12 Class 6 - Chapter 4: Engaging Students in Science Process Skills

Week Four
Reading: Chapters 4 and 5
9.17 Class 7 – Chapter 4: Engaging Students in Science Process Skills
9.19 Class 8 – Chapter 5: Taking Science Outside the Classroom

Week Five
Reading: Chapters 5 and 6
9.24 Class 9 – Chapter 5: Taking Science Outside the Classroom
9.26 Class 10 – Chapter 6: Exploring Properties of Matter
Week Six
Reading: Chapters 6 and 7
10.1 Class 11 – Chapter 6: Exploring Properties of Matter
10.3 Class 12 - Chapter 7: Explorations of Living Things

Week Seven
Reading: Chapter 7 and 8
10.8 Class 13 - Chapter 7: Explorations of Living Things
10.10 Class 14 - Chapter 8: Explorations of Density

Week Eight
Reading: Chapter 9
10.15 Class 15 – Chapter 9: Using Models and Engineering Design for Teaching and Learning Science
10.17 No Class - Mid-term Break

Week Nine
Reading: Chapters 9 and 10
10.22 Class 16 - Chapter 9: Using Models and Engineering Design for Teaching and Learning Science
10.24 Class 17 - Chapter 10: Breaking Out of the Science Box

Week Ten
Reading: Chapters 11
10.29 Class 18 - Chapter 11: Science Content and Curriculum: The Big Ideas and Your Scientific Self
10.31 Class 19 - Chapter 11: Science Content and Curriculum: The Big Ideas and Your Scientific Self

Week Eleven
Reading: Chapters 12
11.5 Class 20 - Chapter 12: Surrounded by Science: Making Science Connections
11.7 Class 21 – Lessons

Week Twelve
Reading: Chapters 13
11.12 Class 22 – Chapter 13: Planning for Science: Lesson Plans and Instructional Strategies
11.14 Class 23 – Lessons

Week Thirteen
Reading: Chapters 14
11.19 Class 24 – Chapter 14: What's the Big Idea: Assessing for Understanding
11.21 Class 25 – Lessons

Week Fourteen
Reading: Chapters 15
11.26 Class 26 – Chapter 15: Pulling it All Together: Reflection and Self-Assessment
11.28 No Class - Thanksgiving

Week Fifteen (Dead Week, last class on Thursday)
Thematic Units due on Tuesday
12.3 Class 27 – Unit Presentations and Reflections
12.5 Class 28 – Unit Presentations and Reflections